WT 07-121

Before the
Federal Communications Commission
Washington DC 20554

In the Matter of	)	
	)	
Request for Declaratory Ruling on	)	File No. _____
Compliance of Fixed Microwave	)	
Antennas Having Distributed	)	
Radiating Elements	)	

REQUEST FOR DECLARATORY RULING

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A. Introduction

Recent advances in antenna system design enable a Fixed Services licensee to use otherwise unavailable spectrum, without causing interference to other users, through the use of antennas having distributed radiating elements.

Pursuant to Section 1.2 of the Commission's Rules, Wireless Strategies, Inc. respectfully asks the Commission to issue a declaratory ruling confirming that a Fixed Service licensee is permitted to simultaneously coordinate multiple links whose transmitter elements collectively comply with the Commission's antenna standards[1] and frequency coordination procedures.[2] The requested ruling is needed to eliminate any uncertainty as to the lawfulness of these methods for enhancing spectrum efficiency by allowing a licensee to reuse the licensed spectrum in a given area.

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1 47 C.F.R. Sec. 101.115.
2 47 C.F.R. Sec. 101.103.

B. Underlying Regulation

The technology described below complies in full with the two relevant regulatory regimes: antenna radiation patterns and frequency coordination. We briefly summarize each in turn, and then show how the proposed technology can comport with each.

1. Antenna radiation patterns

The Commission requires that transmitting antennas used in the Fixed Service be highly directional. The rules specify, among other things, the location of the radiating source,[3] the maximum power in the direction of the antenna's main lobe,[4] and the minimum radiation suppression in each direction, relative to the main lobe.[5] Figure 1 shows a schematic example.[6] The distance from the center of the diagram to an arc, in any direction, represents the maximum signal power permitted in that direction. (The arrow marks one example.) The overall shape is the Radiation Pattern Envelope (RPE).

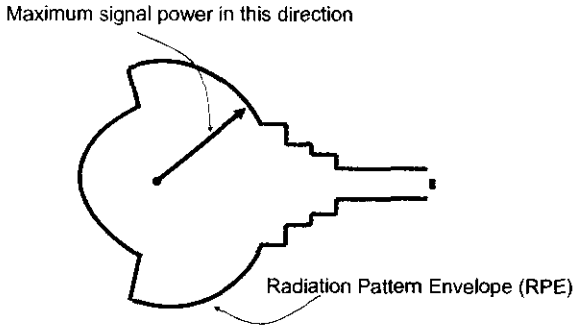

Figure 1

[3] 47 C.F.R. Sec. 101.103.

[4] 47 C.F.R. Sec. 101.113.

[5] 47 C.F.R. Sec. 101.115.

[6] The diagram Figure 1 is simplified for clarity and represents the antenna's required directivity. The diagram is different for each frequency band. Moreover, there are two sets of standards in each band, Standard A for use in congested areas and a less stringent Standard B for use elsewhere.

The technical basis for these patterns is the dish antenna,[7] the most popular directional design for the past fifty years, consisting of a parabolic dish and a radiating element. The emissions from a dish antenna -- indeed, from any directional antenna -- are characterized by a "main lobe," representing the energy in the direction the dish is pointing, and "side lobes," which denote unwanted energy in other directions. See Figure 2. The presence of the side lobes arises from the physics of radio waves. The side lobes can be reduced somewhat by using a larger dish, but they cannot be eliminated. The radiation pattern in Figure 1 is intended primarily to limit the side lobes, which must fit within the RPE. See Figure 3.

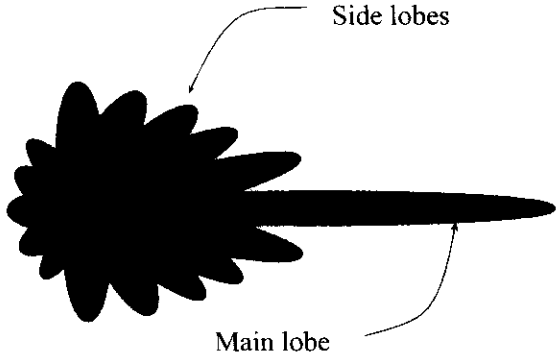

Figure 2

[7] *See More Flexible Standards for Directional Microwave Antennas*, 12 FCC Rcd 1016 at para. 8 (1997).

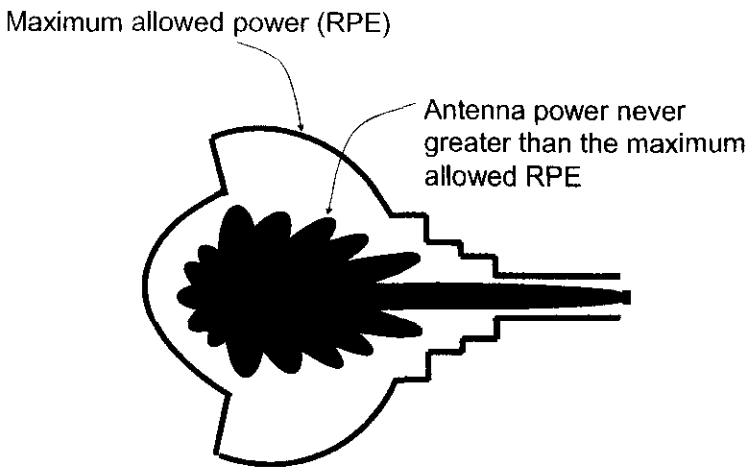

Figure 3

Conventionally the antenna radiation pattern has been generated by a single transceiver and a parabolic dish antenna with a radiating element (feed horn or dipole) at the focal point of the dish. But, nothing in the Commission's rules requires licensees to use a parabolic dish antenna. The radiation pattern could be generated by a phased array antenna with multiple transceivers and dipole radiators, "smart antenna"[8] with multiple distributed transceivers and radiating elements, a transceiver with a multiple array flat panel, or anything else which complies with the rules.

2. Frequency coordination

Fixed wireless links in most bands must be frequency coordinated prior to filing the FCC application. The frequency coordination procedure establishes that the proposed link will cause no harmful interference to existing links (or to satellite earth stations, in shared bands), and advises the applicant of potential incoming interference from existing links and earth stations.

[8] A smart antenna is an antenna system that combines an antenna array with a digital-processing capability to transmit and receive in an adaptive spatially sensitive manner.

The coordination procedures entail giving advance notice of the proposed facility to all licensees and prior applicants within a "coordination area" whose size measures in thousands of square miles. This area is drawn to contain all stations that could plausibly receive interference from, or cause interference to, the proposed station.[9] In practice, the proposed station may be compatible with many stations in the coordination area, due to such mitigating factors as terrain, relative orientation of transmit and receive antennas, relative power, antenna size, polarization, and other considerations.

Frequency coordination necessarily takes into account emissions from the side lobes of the proposed antenna, as well as the main lobe. Because the side lobes vary with the type, make, and model of antenna, the applicant specifies the particular antenna to be used, and the coordinator uses its characteristics in computing possible interference to and from other users.

C. Concurrent Coordination

Spectrum in the areas represented by the transmitter side lobes is presently unused by the licensee. Others attempting to use it would fail in coordination, and if they persisted, would receive or cause interference. In short, this spectrum is wasted.

Thanks to advances in the design of smart antennas, it is now possible for the licensee of the main link to communicate with locations in the side lobe areas, thus putting this resource into productive use. See Figure 4.

[9] 47 C.F.R. Sec. 101.3 (definition of "coordination area").

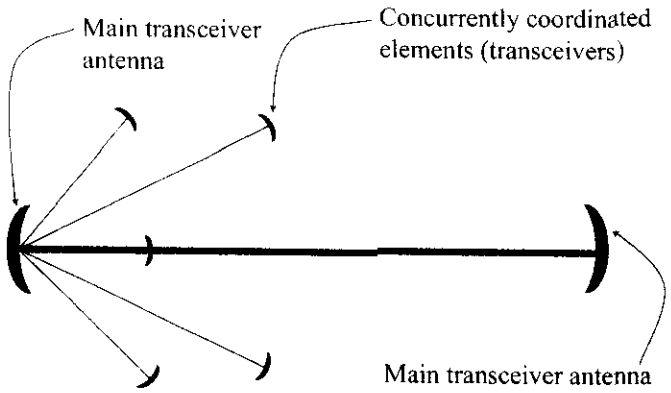

Figure 4

The technology employs multiple radiating elements operating under control of the main link transceiver, although they may be physically separate from it. That is, in addition to transmitting energy along the main beam to a distant receiver, modern systems can employ multiple elements to utilize the side lobe energy so as to serve additional locations. At the same time, however, the totality of all emissions from the multiple elements must lie within the permissible RPE of the main link antenna. See Figure 5.

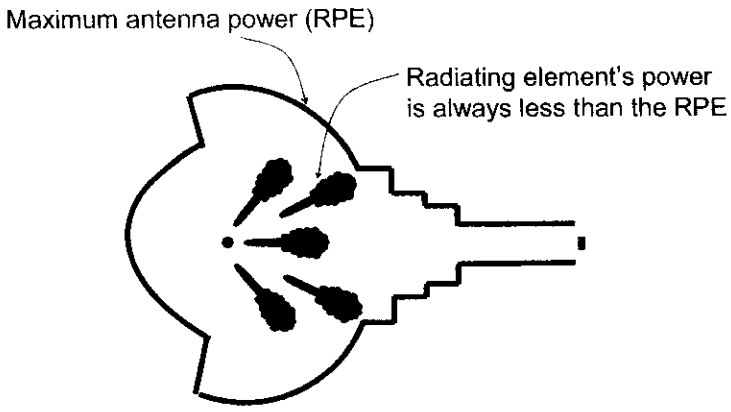

Figure 5

We submit that this practice conforms to all applicable Commission Rules. The system complies with frequency coordination requirements because the antenna characteristics provided by the applicant to the coordinator, in addition to describing the main lobe, also incorporate the properties of the multiple distributed elements to be used for communication with other locations. We refer to these transmissions as "concurrently coordinated" because they are coordinated simultaneously with, and ancillary to, the main beam. Because they are fully coordinated, subsequent operation of those links will not cause harmful interference to other Fixed Service or earth station licensees.

D. Request for Ruling

Wireless Strategies seeks a ruling that a licensee may use antennas having distributed elements to operate links, in addition to the main link, subject to conditions that (1) all radiating

elements together conform to the applicable antenna radiation pattern in Section 101.115, and (2) all links are successfully coordinated.[10]

Such a ruling is fully consistent with Section 101.103(a), which states in pertinent part:

> Assignment of frequencies will be made only in such a manner as to facilitate the rendition of communication service on an interference-free basis in each service area. Unless otherwise indicated, each frequency available for use by stations in these services will be assigned exclusively to a single applicant in any service area.[11]

Nothing we can find in the rules restricts the "single applicant" in this provision to a single link, so long as additional links do not create interference to other users.

E. Public Interest

A grant of the requested declaratory ruling will directly support stated Commission goals:

- to maximize efficient use of spectrum;
- to minimize regulation where appropriate; and
- to facilitate innovative service and product offerings[12]

The Commission generally allows manufacturers and operators to decide how best to achieve compliance with the technical limits.[13] For example, the rules specify the maximum effective isotropic radiated power (EIRP) of a transmitter and the maximum out-of-band emissions, but do not state how the microwave signal is to be generated, or how the off-channel emissions are to be

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[10] Although there are no technical reasons why the distributed radiators could not be mobile, the present rules describe only fixed operation. Therefore, mobile operation is not made a part of this petition.

[11] 47 C.F.R. Sec. 101.103 (a).

[12] *See* http://wireless.fcc.gov/organization/#goals (as of Feb. 23, 2007).

[13] *E.g.*, 47 C.F.R. Secs. 101.101, 101.147 (frequencies), 101.107 (frequency tolerance), 101.109 (bandwidth), 101.111 (out-of-band emissions), 101.113 (power), 101.115 (off-axis antenna suppression), 101.141 (spectrum efficiency), 101.143 (path length).

suppressed. Manufacturers are free to innovate -- to improve performance and reduce costs -- so long as their products remain within the envelope established by the rules.

Similarly, the rules specify antenna performance, but are flexible on how that performance can be achieved. Emerging technologies now make it feasible to deploy antenna systems with radiators that are physically distributed, but which are electrically an integral part of the main antenna system. This arrangement allows the licensee to provide additional service by reusing the licensed spectrum on multiple paths, without increasing interference to other users.

The advantages of concurrent coordination include:

- # additional service without tying up additional spectrum;
- # provisioning time reduced from weeks to hours;
- # increased competition for broadband delivery -- or end-user service in places where it is not presently available,
- # less demand on Commission licensing resources;
- # large and expensive antennas not required for the subscriber end of concurrently coordinated links;
- # suitable for inexpensive (WiMAX) equipment;
- # additional subscriber (retail) revenue increases the provider's return on investment, and
- # lower user prices overall.

F. Conclusion

The Commission is under increasing demands to accommodate more users in existing spectrum. Through innovation, it is now possible for industry to make more effective use of co-frequency spectrum in near proximity to a Fixed Service transmitter to support both the

traditional base of critical infrastructure and business communications, and also incoming services (WiMax) and future advanced services (4G and beyond). A ruling to confirm that antennas with distributed radiating elements are permitted under Part 101, as described above, will put that wasted spectrum into productive service.

Respectfully submitted,

By: _____

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